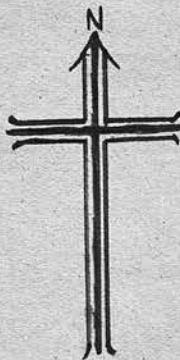


S U D A N .

ABYSSINIA

SKETCH MAP  
OF  
TURKANA



Scale of Miles.

0 10 20 30 40 50

UGANDA

TURKANA

L A K E  
R U D O L F .

LOMOGOL.

LOMOGOL RIVER.

KALION. PASS

KABUA

LODWAR.

MURUASIGAR  
MTs

KAWALAS RIVER.

TURKWELL RIVER.

LOROBUMU

KOLIBIR RIVER.

EAST AFRICA.

MOROTO RIVER

MOROTO

M. MOROTO

HALABATA RIVER.

SOME OBSERVATIONS on the MEDICAL ADMINISTRATION  
of the NORTHERN FRONTIER of BRITISH EAST  
A F R I C A .

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A T H E S I S for the DEGREE of M.D.,  
EDINBURGH UNIVERSITY

by

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## I N T R O D U C T I O N.

After some fifteen months' experience as a medical officer in British and German East Africa, the greater part of which time was spent with a battalion of the King's African Rifles in the field, but which period also included several hospital appointments, I was sent to the Northern Frontier of British East Africa in the Spring of 1918 as Senior Medical officer to the Turkana Expedition.

It is proposed in this Thesis to give a brief account of the Expedition, with observations on the medical administration: Suggestions for the re-organisation of the medical services in the Northern Frontier: A summary of the principal diseases encountered, with special reference to Malaria, its prophylaxis and treatment.

## TURKANA EXPEDITION. 1918.

In the Autumn of 1917, it was decided by the Governments of East Africa and the Sudan to undertake a combined expedition against the tribes inhabiting the Southern Sudan and that part of the Northern Territory of East Africa lying to the West of Lake Rudolf.

The /

The Objects of the Expedition were -

- (a) The disarmament and punishment of certain tribes for raids on friendly tribes under our protection.
- (b) The expulsion of Abyssinian marauders from British Territory to the West of Lake Rudolf.
- (c) The reduction of the Northern Turkana area to a state suitable for civil administration.
- (d) The recovery of cattle and other stock looted from the friendly tribes.

A junction of the East African and Sudan Forces was effected in the North East of Uganda on the 14th of December 1917. The combined Force numbered about seven hundred African Native Troops, with some fifty British officers including medical personnel. Each part of the Force was responsible for its own medical services, the medical personnel of the East African Force consisting of two medical officers, three assistant surgeons and six dressers of the African Native Medical Corps.

A temporary base was established on the slopes of Mount Moroto, at which place a police depot had been maintained for some years for the administration of the Karamojan area. The expedition then advanced towards Lake Rudolf, an advanced base being formed near the shores of the lake, at a place named /



named Kabua. Several weeks were spent here in making preparations for a move northwards, strong patrols in the meantime being sent through the district to subdue the local tribes.

Towards the end of February a somewhat serious situation developed owing to the disaffection and mutiny of a detachment of the King's African Rifles. This detachment was composed of ex-German askaris recruited from our Prisoners of War Camps. Fortunately we were able to disarm this detachment before serious trouble arose, but considerable delay was caused before these troops were replaced by fresh troops from Nairobi. It was therefore about the end of April 1918 before the Expedition was able to move North.

In the middle of April I was appointed Senior medical officer of the East African Force and proceeded from Nairobi to join the expedition. Travelling by rail from Nairobi to Kisumu, then by steamer across Lake Victoria Nyanza and down the Victoria Nile I landed on the shores of Lake Kioga. From there, after about ten days' march, I arrived at Moroto, where I took over medical charge of the Troops. It had already been arranged that one medical officer, one assistant surgeon and four dressers /

dressers were to accompany the expedition. One assistant surgeon and one dresser were to remain at the advanced base at Kabua. Another assistant surgeon was to be at the intermediate post of Loro-gumu, and the Senior medical officer with the remaining dresser at Moroto. Arrangements had also been made that all casualties as far as possible were to be collected at Kabua, and from there evacuated to Moroto as quickly as the available transport permitted. With the exception of a few tents and grass huts, no provision had been made at Moroto for the reception of sick and wounded. The first few weeks were therefore spent in constructing a hospital of sorts in preparation for any casualties which might occur. Instructions were also sent to the two forward posts that temporary hospitals were to be commenced immediately. I was assured that the expedition had an adequate supply of medical equipment, but it afterwards transpired that much of this equipment had never reached them owing to transport difficulties. The arrangements for the transport of casualties left much to be desired. A scheme had been devised by which porters and donkeys used for the transport of supplies were to become available for the transport of casualties as the supplies were consumed /



consumed. This scheme worked badly in practice as it was found that the ordinary wastage of the campaign absorbed all the spare carriers and animals.

About this date a number of cases of cerebro-spinal meningitis made an appearance amongst the Troops, which still further delayed the expedition.

In spite of all these difficulties, however, the expedition at last moved North and established a post near the North end of Lake Rudolf. Strong detachments were sent out from here in all directions during May and June, several small actions being fought with comparatively few casualties. On the 27th of May one of these patrols encountered a force of some four hundred Abyssinian marauders and, after an engagement lasting some five hours, the enemy who had suffered heavily retired into Abyssinia. Our casualties consisted of three Sudan native officers and some ten other ranks killed, with about the same number of wounded.

In view of the hostility of the tribes in this part of the country and the length of our lines of communication it was found impossible /

impossible to maintain a permanent post at the North end of the lake. It was therefore decided that the expedition should return to Kabua, and that a permanent defensive line of posts should be constructed along the Turkwell river from Lake Rudolf in the East to Moroto in the West.

The expedition had captured a large amount of stock including cattle, camels and donkeys, also a considerable number of rifles. It had restored British prestige in the district, prepared the way for future civil administration by subduing some of the more turbulent tribes, and had taught the Abyssinians that they could not raid our territory with impunity. The objects of the expedition had therefore been fulfilled to a large extent, and the Sudan Force were able to leave for their own country about the end of June, the East African Force remaining to consolidate the position.

Fortified Posts were quickly established at Kabua, Lorogumu and Kaliow Pass, with a permanent base at Moroto. While this was being done the sick and wounded were evacuated to Moroto. The whole Force, both Europeans and Natives, was subjected to a medical examination and all unfit men were also sent /



sent to the base. At Moroto a sick convoy was formed which left for Nairobi under a medical officer a few weeks later.

The next two months were spent in visiting the different posts and making myself thoroughly familiar with the nature of the country. I also accompanied several detachments when out on patrol, and in this way much valuable experience was gained. The health of the Troops on the whole was good, comparatively few casualties had been suffered up to date and the medical arrangements had been sufficient to cope with the situation with fair success. It was, however, felt that we were more or less living on the edge of a volcano, and that a serious military situation might develop without warning, and that a thorough re-organisation of the medical administration was necessary. In the Northern Frontier district many problems present themselves which are not met with in other parts of the Colony, the conditions probably being more or less analagous to those pertaining in the Northern Frontier of India.

The following suggestions on re-organisation are based on notes made while stationed in the district. I was able to carry out many improvements before leaving the country in January 1919, but much remained to be done.

SUGGESTIONS on the MEDICAL ADMINISTRATION  
of the NORTHERN FRONTIER DISTRICT of  
BRITISH EAST AFRICA.

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A knowledge of the Geographical position and Topography of the country is of some importance. The country lies a few degrees North of the Equator between Lake Rudolph in the East, and UGANDA in the West. It is bounded by Abyssinia and the Sudan on the North. It forms part of the great African Rift and consists chiefly of a sandy desert plateau about a thousand feet above sea level. Several high mountain ranges rise out of this plateau, more especially in the North and West. Lying so near the Equator and at a comparatively low elevation the country is extremely hot and sand storms are of frequent occurrence.

A number of rivers flow through the country, but except in the rainy season these are quite dry, the water flowing along the river bed many feet below the surface. In the West the great Escarpment divides the TURKANA plains from UGANDA, the level of/  
of/



of the country rising in a few hundred yards to about four thousand feet above sealevel. On the top of this escarpment, Moroto, our base of operations, is situated.

The tribes inhabiting the country are turbulent nomadic peoples, possessing large herds of cattle, sheep, camels and donkeys. Marauding bands of Abyssinians are continually entering the country from the North, bartering rifles with the tribes in exchange for cattle and inciting them to attack the friendly tribes under our protection further South.

The Northern Frontier district includes some of the Territory of Uganda as well as that of East Africa, but it is essential that steps should be taken by the two Governments to arrange for one medical administration for the whole area, and this administration should be carried out on one basis, either military or civil.

The present scheme of defence provides for a chain of posts being established across the country with a base at Moroto. A mobile striking Force of some two hundred rifles is to be stationed at Kabua to be ready at short notice to move out against any hostile raiders.

In /

In view of the length of our line of communications, Moroto being some thousand miles distant from Nairobi by the present route, it is essential that the Northern Frontier Force should be as far as possible a self-contained unit. During the wet season the district is often, for several weeks, out of communication with the outside world. The medical service must be able to meet all contingencies, as it will usually be impracticable to evacuate casualties except at infrequent intervals.

#### MEDICAL PERSONNEL.

The District should be in charge of a Senior Medical officer, who should be responsible for the medical administration of the area. He should have a staff of an assistant medical officer and three assistant surgeons, men holding an Indian qualification and having considerable knowledge of medicine and surgery. Twelve trained African native dressers and fifty trained stretcher bearers should be also allotted to the Force. It has been the custom in the past to use untrained native carriers as stretcher bearers. The system is bad, the men being usually raw savages who not infrequently desert when most required.

Under /



Under this scheme a much larger proportion of medical personnel is provided for than is usually allotted to a Force of some five hundred rifles. It must be kept in mind, however, that conditions in this district are peculiar, and that increasing demands are being made on the medical administration by the native civil population. This personnel will allow an assistant surgeon, two dressers and eight stretcher bearers to be stationed at each post. The assistant medical officer, four dressers and twenty stretcher bearers would be attached to the mobile striking force. The Senior medical officer would be in charge of the base hospital at Moroto and should also be able to travel through the country inspecting the various posts from time to time. The stretcher bearers should be trained in sanitary duties as well as stretcher drill, and should be responsible under the medical officer for the sanitation of posts and camps.

#### HOSPITALS.

A Base Hospital of fifty beds should be built at Moroto and should provide separate accommodation for Europeans and natives. Several small buildings are useful for the segregation of certain diseases. An isolation block should also be built  
 some/

Some distance from the camp for infectious diseases. An operation theatre, dispensary and medical inspection rooms are essential, and huts should be provided for the accommodation of the hospital staff. The hospital should also have its own cookhouse, incinerators, latrines, etc. The whole of the hospital buildings should be surrounded by a fence, and round the isolation hospital in particular this should be of an impenetrable nature. The hospital buildings should not consist of grass huts, tents or other makeshifts, but should be of a more permanent character. Abundance of building material is always at hand. The buildings should be constructed with a framework of logs. The walls should be made of stone or wood, plastered with mud and whitewashed. The roof should be thatched, and the thatching of sufficient thickness to be impervious to rain, and to render the interior of the building sunproof. Excellent beds can be improvised by stretching poles across forked sticks, and good mattresses can be made from grass. At the other posts hospitals can be built on a much smaller scale, and only accommodation for natives need be provided. Europeans can be treated in their own quarters pending evacuation to Moroto.



MEDICAL EQUIPMENT.

As it takes at least a fortnight for supplies to reach Moroto from Nairobi under the most favourable conditions, and very much longer during the rainy season, a supply of medical equipment sufficient to last for six months should be kept in stock at the base. An adequate supply of drugs and dressings should be maintained at each post, and a case of major operation instruments of the modern army pattern is also necessary. Special boxes should be provided for the transport and storage of medical material. These should be of strong construction and waterproof, and as light as possible. The boxes, when full, should weigh approximately fifty pounds, the weight usually carried by a native porter. The boxes should also be so constructed that they can be clamped together and hooked on to saddles when animal transport is available. Camels, mules and donkeys are all used for transport in different parts of the district. A donkey can carry two, a mule four, and a camel six boxes of this pattern, and if each box weighs fifty pounds the load is equally distributed on each side of the saddle. At the different posts drugs can be used in practically any form, but on patrol the tablet form of drugs should be provided as far as possible, on account of their convenience /

convenience and economy of space. Compressed dressings and bandages also economise space. All bottles and other receptacles should be enclosed in wooden or metal cases if not made of unbreakable material.

A microscope and its accessories should be provided at the base hospital at Moroto for bacteriological diagnosis. No microscope was provided in the 1918 expedition, causing great inconvenience, all pathological specimens and slides having to be sent to Nairobi or Kampala.

Sterilizers of different sizes, and preferably of the fish-kettle pattern are essentials at each post.

Simple operation theatre furniture of a portable nature should be provided at Moroto.

#### MEDICAL TRANSPORT.

The Transport question is one of the most difficult problems to solve in the Northern Frontier district, owing to the distance from civilisation and the absence of roads. The distance from Lake Rudolf to Lake Kioga is about two hundred and fifty miles. It is therefore necessary to make adequate provision /



provision for the transport of casualties until they can be placed on board the steamer on Lake Kioga en route for Nairobi. During the expedition all stretcher cases had to be carried the entire distance by native porters, a most unsatisfactory arrangement and one requiring a large number of porters. No wheeled transport of any description was available.

A proper road is now being constructed from Lale on Lake Kioga to Moroto. This road passes over two large swamps, and in the wet season it is doubtful whether it will be passable. During the dry season, however, it will improve this section of our lines of communication to a great extent. When the road is completed a motor ambulance will solve the problem in this part of the route. Forward of Moroto, in Turkana proper, it is doubtful whether motor ambulance transport would be of much use. The construction of a suitable road down the escarpment would present great engineering difficulties, and it is questionable whether the expense would be justified. Considerable labour would also be entailed in building roads suitable for motor transport in the loose sandy soil of Turkana.

An improvement in the present form of hand  
stretcher /

stretcher is essential, as at least four porters are required to carry a stretcher, and more on a long journey. The provision of stretchers on wheels would effect a great economy in stretcher bearers and add to the comfort of the patients. The two-wheeled type is the more useful, but a one wheeled type has the advantage in bush and mountainous country. All stretchers of whatever pattern should be partly covered in so as to render them sun proof, thus minimising the risk of heat stroke.

Hammocks slung on a long pole also proved useful when the roads and paths were very narrow.

Donkeys and mules should be utilized for the transport of minor casualties able to ride. Use might also be made of camel transport as is done, I believe, in Egypt and India. A canvas or leather chair on a metal or wood framework is slung on each side of the saddle. A camel is thus able to carry two patients in the semi-prone position.

#### WATER SUPPLY.

The water supply on the Northern Frontier is always an acute question. The rainfall in Turkana proper is negligible, and the country is badly watered /



watered. Most of the rivers have their source in the mountains to the North and South, and flow towards Lake Rudolf. After heavy rainfall in these mountains the rivers flow for a few days, but for the greater part of the year the river beds are quite dry, any water in them flowing many feet below the surface. At each post a waterhole has been sunk in the river bed, in some cases to a depth of thirty feet, and this served as a water supply for Europeans, natives and animals. This water supply was therefore liable to much contamination. Every post should be provided with three such waterholes, one for Europeans, one for natives, and one for animals. The European supply should be the furthest up stream, and the animal supply the furthest down stream. Each waterhole should have a distinctive sign, and should be properly fenced in to prevent animals both domestic and wild from contaminating the water. All water must be boiled before use, and this rule should apply to natives as well as Europeans. If possible this should be done on a large scale, boilers being erected near the waterholes, and proper tanks provided for the boiled water. Water bottles, canvas water carrier tanks, etc. should be cleansed and inspected at frequent intervals under the supervision of /

of a medical officer. If these steps were rigidly enforced Troops would suffer much less from Typhoid fever, Dysentery and other allied diseases.

GENERAL SANITATION and ADMINISTRATION.

In a country which abounds with flies it is important that all refuse should be burnt daily. Good incinerators can easily be constructed with stones and mud and a few iron bars. Animal dung, which should always be burnt, provides good fuel for the incinerators. The pan system of latrines with pails for Europeans has proved the most satisfactory. The pans and pails should be emptied and cleansed twice daily, and the excreta burnt. On patrol field latrines should be dug each day. It is of great importance that all camp followers should be taught to use latrines as well as the native troops.

The Senior Medical officer should have his headquarters at Moroto, as all troops and supplies proceeding to or from the Northern Frontier must pass through this place. Troops as they arrive should be subjected to a strict medical examination, before being allowed to proceed up country. In view of the prevalence of Smallpox and Typhoid fever, no man should be /



be passed who has not been recently vaccinated against Smallpox and inoculated against Typhoid. At Moroto the senior medical officer has also an opportunity of inspecting all food supplies. Medical equipment arriving in bulk can be divided up and sent forward to the different parts as required. Moroto is in many respects an ideal place as a base of operations. Standing some four thousand feet above sealevel, the climate is very pleasant. A small river <sup>straight</sup> issuing from the mountain flows through the station, providing a permanent and abundant water supply. The soil along the banks of the river is very fertile. As cultivation in Turkana proper is impossible it is of great importance to grow as many vegetables as possible at Moroto. I tried this on a small scale before leaving the country, and was able to forward a supply of fresh vegetables to the posts in Turkana every week. If fresh vegetables are not available a ration of limejuice should be issued to all troops on a liberal scale. The keeping of Poultry should be encouraged at each post in order to have a supply of chickens and eggs for patients on light diet. Europeans should be encouraged to take exercise in some form every evening, and for this purpose should be advised to bring shot guns and games equipment to the district with them. If this were done the neurasthenic element which enters so much into all diseases in the Tropics would tend to be eliminated.

A SUMMARY of the PRINCIPAL DISEASES  
encountered in  
EAST AFRICA.

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The following Summary includes some of the more common diseases met with in East Africa in general. The list is by no means exhaustive, and with the exception of Malaria only a short account is given of each disease. The diseases are discussed chiefly from the clinical standpoint, most cases having been diagnosed from their clinical signs and symptoms. Bacteriological diagnosis was usually impossible in the field. The majority of the hospitals also to which I was attached offered few facilities for Bacteriology, many of them not even being equipped with a microscope.

THE PROPHYLAXIS and TREATMENT  
OF MALARIA.

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Of all the diseases met with in East Africa Malaria stands pre-eminent, the disease being responsible for more sickness and mortality in the campaign /



campaign than any other disease. Practically every European serving in this theatre of war suffered from malaria at one time or another. Throughout the Tropics malaria causes more wastage, misery and mortality than any other disease, Cholera and Plague included. The future European colonisation of the countries in which the disease is endemic depends on the solution of the malaria problem. The question of malaria in these countries is of as much importance as the question of Tuberculosis in the United Kingdom. It has been proved time and again that much of this malaria is preventable if proper measures are adopted. The Roman Campagna, the historical home of malaria provides a striking example of this. By preventive measures this area has been rendered a comparatively healthy district. Extensive prophylaxis has also been carried out in the region of Panama, with marked success.

West Africa also provides another example, a country which was once known as the "white man's grave". The prophylaxis of malaria on an extensive scale is therefore of the first importance in all countries where the disease is endemic.

PROPHYLAXIS of MALARIA.

As malaria is transmitted to man by means of certain species of mosquitoes, all prophylactic measures must aim at the extermination of the mosquito, the protection of the individual from its bites, and the prevention of the transmission of the disease from individuals already infected.

Prophylactic measures may be divided into general and personal, the former including steps taken by a community to exterminate mosquitoes, and the latter steps taken by an individual to prevent himself being infected.

GENERAL PROPHYLAXIS.

In the Tropics particular attention should be paid to the site, construction and sanitation of all buildings inhabited by Europeans. Houses should be built on high ground, preferably on a slope, but should be sheltered from the prevailing winds. They should not be built on low lying ground or in the vicinity of swamps or sheets of water. All vegetation should be cut and cleared away in the surroundings of the building. The ground should be planted /



planted with grass, which should be kept short. Proper roads with a hard surface should be constructed, and all irregularities in the ground should be filled in. Pools of water lying in cart ruts and the hoof impressions of animals are favourite breeding places of the mosquito. The edges of swamps and lakes and sluggish streams also provide good breeding places. Swamps if possible should be drained and planted with grass. If this is impossible complete flooding is an alternative. The edges of lakes and streams should have all vegetation and undergrowth cleared away, and be cut and trimmed to prevent the water becoming stagnant in small irregularities. The cultivation of certain species of fish, which feed on mosquito larvae, is also of importance. This was carried out at Dar-es-Salam in German East Africa before the war with considerable success. A small quantity of paraffin oil, petrol or similar substances poured on small ponds or pools of water will prevent mosquitoes from laying their eggs, and will kill the larval forms. Belts of trees should be planted round, but some distance from European dwellings. These may act as a sort of mosquito filter, in which mosquitoes coming from a source of infection are caught. They are also beneficial in sheltering the buildings from the winds etc.

Houses should be so constructed as to be mosquito proof. All windows, doors and other openings, including chimneys, should be protected by wire screens of a sufficiently small mesh to exclude mosquitoes. Doors should be provided with springs to keep them shut, and should open outwards. Double doors are an advantage. Verandahs should be covered in in the same way.

No native huts or villages should be permitted within half a mile of European dwellings. Particular attention should be paid to sanitation in the Tropics, in the prophylaxis of malaria. All tanks and other receptacles in which water is stored should be screened with wire gauze to prevent access of mosquitoes. House refuse should be kept in covered bins, and should be removed daily and burnt. Empty tins, jars, bottles, etc. should be buried after passing through an incinerator as they are apt to get filled with water, and thus become potential breeding places for mosquitoes. Fumigation of dwellings should be undertaken from time to time, in order to destroy any mosquitoes which have got into a house.

Mosquito traps in my experience have been of little use in the prophylaxis of malaria. They are usually out of working order, and in any case require /



require considerable attention.

Prophylaxis chiefly aims at the protection of the European population, the natives having to a large extent acquired immunity to the disease. I have, however, come across several native tribes inhabiting the highlands of East Africa, who are no more immune to malaria than the white man. It must also be remembered that although the native population may be immune to the disease, the parasite of malaria may still exist in the blood, and every native is thus a potential source of infection to the European community.

#### PERSONAL PROPHYLAXIS.

The Psychological aspect of this question is important. The average European arrives in the Tropics with the idea that malaria is a disease which everybody must get sooner or later, and which it is little use fighting against. Education along certain lines might do much to eradicate this belief. If everybody in the community took an active part in prophylactic measures, the incidence of malaria would be much reduced. The chief aim of personal prophylaxis is to prevent the individual being bitten by the mosquito. This must be looked upon as the first /

first line of defence, and is of far greater importance than the taking of Quinine or other drugs. The mosquito being specially active just about sunset and dawn, special precautions should be taken at these times. In malarial districts Europeans should always sleep under mosquito nets. These should be of the rectangular pattern, and as large as possible. The triangular pattern is bad, as the sleeper is more liable to come in contact with the sides of the net and get bitten through it. The net should have at least 16 meshes to the linear inch, and should be kept in good repair, as a mosquito will get through the smallest tear. Nets are usually white in colour in order that any mosquito that has got inside may be the more easily detected. Nets should be used at all times, especially in the field, and with a little forethought this can generally be done. The white colour of the net is often an objection from the military point of view, as it is apt to give away a position. In German East Africa I had the nets of my battalion dyed with coffee, producing a colour which rendered them quite invisible in the dark. Europeans should not be permitted to wear "shorts" after sundown. If they are unable to change into trousers, the shorts should be provided with /



with flaps which can be turned down and fastened by puttees. Mosquito boots are an advantage in the evenings, but the wearing of two pairs of socks is probably equally good. Protection of face and hands is always a difficult problem. Various patterns of veils and gloves have been tried, but they usually cause great discomfort.

Certain volatile oils rubbed on the face and hands have been used to repel mosquitoes. Citronella, Cassia and Bergamot oils combined with kerosine are those usually employed. A saturated solution of magnesium sulphate has also been tried. In my experience these measures were of little use. They are hard to carry out on an extensive scale, afford very doubtful protection, and their effect soon wears off. If other parts of the body are protected a man can usually feel or see a mosquito settling on his face or hands. To prevent infection from being carried from individuals already infected, all malaria patients in hospital should be in bed under the mosquito nets before sundown.

On the subject of Quinine Prophylaxis much has been written, and large series of statistics both for and against have been produced. Experiments have /

have been carried out on this subject especially in Indian jails, and the statistics compiled from these sources have generally proved, though not always, that quinine prophylaxis is of some considerable value. The conditions in these Institutions, however, might be described as ideal, where everything is regulated, and proper discipline maintained. Conditions on active service are far removed from this, it being almost impossible to maintain true quinine prophylaxis in the field. Quinine prophylaxis to be of any use should be started several days before the individual arrives in the country. In East Africa this was seldom carried out, and the majority of the men were probably infected with malaria before receiving quinine. Troops have also an extraordinary objection to taking quinine even in tablet form, and it is only by holding regular quinine parades that the taking of the drug can be enforced. In a country in which patrols and other small bodies of troops were continually being sent out for several days at a time it was impossible to include everybody in these parades, and thus quinine prophylaxis broke down. Although true prophylaxis cannot be maintained, much can be done towards this ideal by enforcing the taking of the drug whenever possible. I carried out some interesting experiments in one company of /



of my battalion in German East Africa. This company was recruited from the Highlands of British East Africa, the natives belonging to it being little more immune to malaria than the white man, and the incidence of the disease was very high. Half this company were given ten grains of quinine every third day, the other half company receiving no quinine at all. After a few weeks the number of cases of malaria in the half company receiving quinine was exactly a third of the number occurring in the other half company. Amongst the officers of my battalion those who took quinine regularly suffered less from malaria than those who did not. The conclusions that I came to were that under peace conditions quinine prophylaxis in the true sense is of undoubted benefit, but under active service conditions too much must not be expected from it.

#### TREATMENT of MALARIA.

The discovery of quinine in the seventeenth century as a specific for malaria is the foundation on which the modern treatment of malaria has been built. Methylene Blue, Puric acid, Arsenic, Antimony Tartrate and many other drugs have been tried in this disease, more especially by those who do not believe /

believe in the specific action of quinine. All great authorities on the subject, however, are agreed that quinine remains our sheet anchor in this disease. Unsatisfactory results in the treatment of malaria by quinine are practically always due to faults in its administration. Malaria, whenever possible, should be diagnosed microscopically, as many other conditions simulate this disease, in which quinine has little or no action. Continuity of treatment, until the condition is cured, should then be aimed at. The method of administration and the dosage are both of importance. While routine methods of treatment are useful as a guide, the individual idiosyncrasy of the patient must not be lost sight of. In East Africa malaria was in most hospitals treated by one routine method, large doses of quinine being administered to every patient, and little attention was usually paid as to whether the drug was being properly absorbed or not. Proper absorption is essential if any benefit is to be derived from the drug. The exhibition of the drug should be pushed until slight symptoms of Cinchonism are present. The absorption of the drug should be attained by regulating methods of administration rather than by increasing the dose. Personal experience has convinced me that it /



it is probably very doubtful whether the human system can absorb more than a maximum of thirty grains of quinine in the twentyfour hours. As the continued administration of large doses of quinine is harmful to a patient, and as the drug is expensive thirty grains per day should be the maximum amount given in an ordinary case of malaria without complications, by oral administrations. There are five different methods by which the drug may be administered, by the mouth, by the rectum, and by intramuscular, subcutaneous, or intravenous injection.

Oral administration is by far the best method, and should always be tried first, and continued provided proper absorption is attained. The drug should if possible be given in the liquid form, the best salts being the Bihydrochloride or the Sulphate. The former is much more soluble but expensive. The sulphate requires the addition of acid to render it soluble. Dilute sulphuric acid is generally used, but hydrobromic acid is said to inhibit the symptoms of Cinchonism to some extent. The chief objection to oral administration is the disagreeable taste of quinine. Manson advocates the giving of the drug in milk after the mouth has been lubricated /

lubricated with bread and butter. Several preparations of quinine, such as ~~Emu~~ quinine, are tasteless. These preparations are usually hard to obtain on account of the question of expense.

Rectal administration is useful where quinine cannot be administered by the mouth. It should be given in dilute solution in double the dose given by mouth. If the injection irritates the bowel it can be combined with a few minims of Tincture of Opium.

Subcutaneous injection offers no advantages, and is often accompanied by loss of sensation round the area injected.

Intramuscular injection is an excellent method of administration when the oral channel is closed. During my time in East Africa I treated several hundred cases of malaria by this method, with on the whole very good results. Attention must, however, be paid in this method to several details of technique. The buttock muscle offers the best site for injection, if proper care is taken to avoid the line of the sciatic nerve. The needle must be plunged deeply into the muscle, and the injection given slowly. When the needle is withdrawn the muscle should be thoroughly massaged to ensure proper diffusion /



diffusion. This aids absorption, and lessens the discomfort and stiffness of the part. Absorption by this method is slower than by mouth, but the effect lasts longer. Sterile ampoules of quinine solution, each containing a dose of ten to fifteen grains, give the best results.

Intravenous injection should always be done in cases of cerebral malaria, where rapid absorption is required. Ten grains of the Bihydrochloride should be dissolved in half a pint of sterile water, and injected by slow transfusion.

During the first week of the malarial attack about thirty grains per day should be administered by the mouth. In East Africa this was usually given in three doses. A better method is probably that advocated by Balfour, where five grains doses are given every two to three hours. This method entails more work on the nursing staff, but in my experience gave much better results than larger doses. Several authorities withhold quinine until the temperature is beginning to fall. Much better results are got, I think, by giving quinine as soon as possible, as in this way one is often able to avert an attack or render it less severe.

A full dose of Calomel followed by a saline purge should always be given at the commencement of treatment. The administration of ten grains of Aspirin along with the quinine at the height of the febrile stage tends to lessen the unpleasant symptoms and aids perspiration. Taylor, a medical officer in Uganda, writing in the British Medical Journal, strongly advocates this procedure, and from my own experience I can fully endorse his observations.

During the first ten days of the malarial attack about thirty grains of quinine should be given daily. During the next ten days twenty grains daily and for a further period of ten days ten grains daily.

As quinine in attacking the malaria parasites destroys many red blood corpuscles, anaemia is always present in this disease. Liquor arsenicalis should be given from the start. In patients who have reached convalescence, and who have been taking quinine for about a month, it is often advisable to withhold all quinine for about a week, and put them on an iron and arsenic tonic instead. I was able to prove the benefit of this procedure when in charge of the convalescent malaria wards at the British General Hospital in Nairobi. The patients in these wards, when I arrived, were receiving large doses /



doses of quinine daily. With the exception of anaemia few clinical signs of malaria were seen, and after some further three weeks of quinine treatment, they were sent to a convalescent camp some seven thousand feet above sealevel to recuperate before returning to the field. Practically all these men had to be re-admitted into hospital within a few days with a malarial relapse. On instituting alternate Quinine and Tonic treatment before the patients were discharged from hospital, the malarial relapses were reduced by one half.

Malarial subjects living in the tropics nearly always have some warning several hours or even days before an attack develops, such as headache, listlessness, insomnia and depression. A large dose of quinine administered during this prodromal period will often ward off an attack or lessen its severity.

In all attacks of malaria early treatment is of great importance, when the natural powers of resistance of the patient are unimpaired. Each attack of fever renders this resistance less complete. Continuous treatment, if possible under one medical officer, is also important, and one month of such treatment should ensure the death of all malaria parasites./

parasites. The medical officer should, however, convince himself, by the routine examination of blood films, that a case is cured before being discharged from hospital.

Various complications may be met with in malaria, such as cerebral symptoms, coma, hyperpyrexia, gastro intestinal symptoms, and excessive enlargement of the spleen.

If cerebral symptoms manifest themselves ten to twenty grains of quinine should be given intravenously. The prognosis in cerebral malaria is always bad, but this treatment offers a good chance of saving the patient's life. Salvarsan and Galyl have also given good results.

Hyperpyrexia may be treated by antipyretics, cold packs or baths. Sudden syncope is apt to occur when the temperature falls, and must be guarded against.

Gastro intestinal symptoms can usually be treated by appropriate dieting. Sodium Bicarbonate or Tincture of Iodine can be given when vomiting is excessive, and Bismuth and opium will usually stop diarrhoea.

Enlargement of the spleen is present in practically /



practically every case of malaria. This enlargement usually passes off as the malarial attack diminishes.

After many attacks of malaria, however, this enlargement may be excessive and assume a more chronic character, the organ often reaching to below the umbilicus.

I have treated several spleens of this nature by counter irritants, combined with internal tonic treatment. Blistering is the best form of counter irritant, diminution in the size of the organ being usually attained. Treatment by X-rays has also been advocated, although I have had no personal experience of this form of therapy.

Splenectomy has been carried out successfully on several occasions. It is a somewhat serious operation and is only justifiable when the organ is of such a friable condition that it is liable to rupture, and when the splenic pain is very severe.

BLACKWATER FEVER.

The Aetiology of this disease is still obscure. Three theories are current. First that it is a manifestation of malaria; secondly that it is a disease sui generis; and thirdly that it is caused by Quinine. The third theory may, I think, be discarded. Quinine may precipitate an attack of this disease, but it is highly improbable that it is the cause of it. In my experience the evidence points towards its being a manifestation of malaria, although Manson and several other eminent authorities tend towards the view that it is a separate disease. The chief points in favour of the malaria theory are that the condition is practically co-endemic with malaria. Malarial parasites are practically always found in patients suffering from Blackwater. It is seldom seen in patients who have not resided at least six months in a malarial country, and individuals who develop Blackwater have usually suffered previously from several slight attacks of malaria. While stationed in East Africa I saw some twelve cases of Blackwater Fever. The symptoms in each case were severe, and five out of the twelve cases ended fatally. The majority of the cases had been in /



in the country for at least a year before Blackwater developed. Two of them occurred after six and seven months respectively. One case developed a few weeks after landing, but on investigating the previous history of this case it was found that the ship which had brought him from England had called at Sierra Leone in West Africa, where he might possibly have been infected with malaria. One of my cases which recovered had had Blackwater Fever on three different occasions during a residence of some twenty years in East Africa. Skilled nursing, absence of movement, and thorough flushing of the kidneys are essential in treatment. Diuretics are practically always contra indicated. Saline enemata may be tried, but subcutaneous or intravenous saline injections must be given in all severe cases. The patient should also be encouraged to take as much fluid as possible by mouth. Suppression of urine is the great thing to be guarded against. Generally speaking Quinine should be withheld in the acute stage, but if malarial parasites are present it may be given, large doses being avoided. Complications must be treated as they arise, and it is advisable that people who have suffered from Blackwater should be invalided out of the country.

CEREBRO - SPINAL FEVER.

This disease is endemic all over East Africa, and at times assumes an epidemic character. The disease is more contagious than infectious, but strict isolation should be the rule in every case. The causal organism was found to exist in the nasopharynx of carriers, although they showed no manifestations of the disease. The chief spread of the disease is probably by these carriers. When a case presents the symptoms of headache, stiffness of the neck, retraction of the head, and a raised temperature and Kernig's sign is present, it should be diagnosed and treated as Cerebro-spinal Fever. A certain amount of mental confusion is also a common feature. A rash, especially in the African native is seldom seen. The virulence of the disease is subject to considerable variation. The prognosis on the whole is bad. I had an experience of some hundred and fifty cases, forty per cent of which ended fatally. Anti-meningococcus serum was not available in any case which I treated, so that I have no experience as to its value. Lumbar puncture afforded marked relief in most cases, from forty to fifty cubic centimetres of turbid fluid usually being withdrawn /



withdrawn. Large doses of Tinctura Chloroformi et Morphinae Co. also afforded relief. I treated a small series of cases in the Northern Frontier with Soamin injected hypodermically. The cases did quite well, and the death rate was only about twenty five per cent. I was inclined, however, to attribute the results of this series rather to a low virulence of the organism than to the action of the Soamin.

Hexamine was also tried in several East African hospitals, and is said to have given good results.

Delirium, insomnia, hyperpyrexia and other complications must be treated as they arise.

The conclusions that I came to were that drugs were of comparatively little value in the treatment of the disease.

#### DYSENTERY.

In East Africa where practically every water supply was liable to contamination Dysentery was responsible for much sickness and mortality amongst the troops. Amoebic dysentery was probably the more common type of the disease, but bacteriological diagnosis was seldom possible in the field.

The /

The differential diagnosis between the amoebic and bacillary types was usually made by the reaction of the patient to emetine. The prophylaxis of Dysentery undoubtedly depends on the provision of an efficient sanitary service. Under peace conditions the disease can be controlled with comparative ease, but with an army in the field the disease presents great problems. The differential diagnosis between amoebic and bacillary dysentery can only be made by aid of the microscope. This should be done in every case where possible. The general treatment of the two forms is the same. Rest in bed is the first essential, the diet being strictly fluid. During the first days of treatment milk should be withheld, and the patient kept on ordinary water, albumen water, barley or rice water, or weak beef tea. After a few days milk may be added, but no solid food should be given until blood and mucus have disappeared from the stools. Magnesium Sulphate should be administered in dram doses every two hours. Dysentery patients suffer much from exhaustion and debility, and it is of great importance that they should have proper sleep. A dose of morphia or chlorodyne in the evening diminishes tenesmus and colic, and ensures a night's rest.

Emetine /



Emetine seems to have a specific action in Amoebic Dysentery, and good results generally follow its use. In the cases which I treated, the drug was given in doses of one grain hypodermically for the period of a week or ten days. Hepatic abscess is an occasional complication of amoebic dysentery, but I only came across three such cases in a series of several hundred cases of amoebic dysentery.

With reference to Bacillary dysentery in East Africa, serum treatment gave good results when available, but in the field most cases were treated by magnesium sulphate.

While stationed near Nairobi I had the opportunity of testing the value of vaccine as a prophylactic for Dysentery. The vaccine which was made in Nairobi contained organisms of the Flexner Shiga and Morgan No.1 group. I inoculated two battalions of the King's African Rifles with this vaccine. Before inoculation a number of cases of dysentery were occurring daily in these battalions. After inoculations the incidence of dysentery was markedly reduced. The protection afforded by the vaccine only lasted, however, for some four to eight weeks. Soon after this I was transferred to German East Africa where I had no further opportunities of testing the value of the vaccine.

GUINEA WORM.

The Guinea worm or *Dracunculus medinensis* is found in certain parts of East Africa, more particularly the country inhabited by the Acholi tribe in Uganda. Several hundred natives were recruited for the King's African Rifles from this district, many of them being infected with guinea worm. I therefore had the opportunity of seeing many cases of this comparatively rare condition. A species of small crustacean acts as the intermediate host for this parasite. An infected crustacean is swallowed in drinking water, and the larval form enters its human host. About a year is said to pass from the time of the larval infection until the pregnant female form presents herself on the surface of the body. When mature the parasite has an average length of about thirty inches, and lies in the connective tissue of the body, either below the skin or between the muscles. The worm by instinct tends to proceed towards water, where she can discharge her embryos. For this reason she usually points on the foot or leg, the scrotum being another favourite site. The worm often coils itself round the leg, giving rise to considerable discomfort, and when in the region of joints causes inflammation, swelling and /



and stiffness. After the worm "points" about one inch per day is protruded, the <sup>GRAVID</sup> ~~growing~~ uterus which extends practically the whole length of the worm emptying itself at this rate. This process usually takes from six to eight weeks, the individual in the meantime being considerably incapacitated. Douching the part with water accelerates the process to some extent. The parasite has a hook at its ~~caudal~~ end which prevents it being pulled out. If traction is exerted the worm breaks and suppuration and inflammation of the part is sure to follow. The natives coil the protruding end of the worm round a small piece of stick and wind out an inch or so daily. A French surgeon, Emily, introduced a much better form of treatment. He injects the worm itself with a few minims of 1 in 1000 Perchloride of Mercury. This kills the worm, and loosens the hook at its ~~caudal~~ end, After some twenty four hours the whole worm can be extracted quite easily. I treated all my cases by this method, and succeeded in removing the parasite in every case without trouble, thus getting a man back to duty within a few days, when the previous treatment had kept him on the sick list for several weeks.

HEAT STROKE.

Heat stroke in East Africa was comparatively rare, if we exclude the large number of cases of cerebral malaria, and cerebro-spinal fever which were wrongly diagnosed as heat stroke. Sun headaches and heat exhaustion were very common. The only case of true heat stroke which I can remember to have seen was a confirmed alcoholic. Sun headache and heat exhaustion were due to inadequate protection of the head and spinal column. Many of the helmets provided for the troops in East Africa were of very inferior workmanship. The provision of sun proof helmets, the routine wearing of spinal pads, and the use of coloured glasses to protect the eyes from the glare of the sun would do much to obviate the condition.

PLAGUE.

Plague is endemic in certain parts of East Africa, especially in the neighbourhood of Nairobi. Both Bubonic and Pneumonic types were seen, the latter being by far the more common. All troops in this area were subjected to prophylactic inoculation, which did much to prevent its spread. A bacteriological /



bacteriological diagnosis is important in every case, as the disease is often confused with Enteric fever and ordinary Pneumonia. The extirmination of rats and destruction of fleas should be undertaken as prophylactic measures, and all cases of plague should be immediately isolated. The extermination of native dogs, which infest all camps, should also be undertaken. The prevention of overcrowding of troops in huts, and good ventilation are other important measures. Serum treatment was of some use when obtainable. The treatment of symptoms as they arise is also of importance, and heart stimulants should be given in every case.

#### RELAPSING FEVER.

Relapsing Fever, or Central African Tick Fever, is a fairly common disease in East Africa, although it was usually confined to certain areas. *Spirochaeta Duttoni* is the organism concerned, and infection is carried by a species of Tick. The cases which I saw were characterised by a sharp attack of fever lasting about three days. There was then an interval of about ten days when another sharp attack of fever developed. If untreated, as many as a dozen relapses may take place. Before the relapsing /

relapsing character of the disease is recognised many cases are mistaken for malaria. I had the misfortune to suffer from this disease myself, so can speak of it from the point of view of the patient as well as that of the physician. Bacteriological diagnosis is again of great importance in this condition. The blood should be examined at the height of the fever as the causative spirochaete does not seem to be found in the peripheral blood stream between relapses.

Salvarsan and Galy1 are the drugs which give the best results in this disease. They should be given as early as possible, and the injection should be given during a relapse. One injection is usually sufficient. I have seen a number of cases treated in this way, and underwent the treatment myself. No more relapses were seen after one or at the most two injections had been given. Cases, which are untreated, ultimately recover after a number of relapses, but the patients are usually much debilitated and unilateral facial paralysis is a fairly common sequel.

As prophylactic measures troops should not be allowed to use native rest houses or huts, which often harbour ticks. Sleeping off the ground, and the /



the use of ordinary mosquito nets are other useful measures. In places where the disease is endemic, huts etc. should be burnt, and the soil dug over, fresh camps being built on new sites.

### S M A L L P O X.

Smallpox is endemic in all parts of East Africa. In the native, however, the disease is usually of a much milder type than in the European. In East Africa there was often great difficulty in distinguishing between severe Chickenpox and Smallpox. It is a good rule when there is any doubt to treat the case as Small pox. The severity of the illness, the distribution of the rash, the character of the rash, and the evidence of vaccination are important points in the differential diagnosis. It will always be a difficult matter to control Smallpox in the Tropics until wholesale vaccination of the natives is undertaken. Vaccination of the African native must be carefully performed to ensure success. The skin is very thick, and it is important to make sure that it has been properly penetrated. The skin is usually very dirty, and must be cleansed. Soap and water should be used, and the skin then rubbed with alcohol or ether. Many of the bad vaccination results /

results obtained in East Africa were due to the use of strong antiseptic such as Iodine for cleansing the skin. A supply of fresh lymph is essential in the Tropics, and the vaccination scars must be protected from the sun until healed.

#### TYPHOID FEVER.

Typhoid fever was comparatively common amongst natives in East Africa, but few cases were seen amongst Europeans. This was due to the fact that the majority of the Europeans had been inoculated against Typhoid and Paratyphoid fevers. The disease is not so severe in the native as in the European. Many cases of Typhoid were undoubtedly wrongly diagnosed as malaria in East Africa, but the possibility of the co-existence of the two diseases must be kept in mind. When bacteriological diagnosis is not available, and the fever does not react to Quinine, Typhoid should always be suspected. The provision of pure water supplies, proper sanitation, and preventive inoculation of all troops would do much to combat the disease. On the Northern frontier a number of cases were seen, but these were confined to the native troops and followers, none of whom had been inoculated.



C O N C L U S I O N .

A large number of other diseases are of course met with in East Africa, some of them, such as Sleeping Sickness and Venereal Disease in Uganda, being of great importance. I have, however, in this thesis included the majority of the principal diseases of which I had some personal experience. To summarise, it will be noted that Bacteriological diagnosis is of paramount importance in practically every Tropical disease. The provision of laboratories and other facilities for Bacteriology should be extended throughout the East African Protectorate, and all medical officers proceeding to this country should be familiar with the more common details of bacteriological technique. Proper sanitation must be provided throughout the country, especially at European Settlements. The native population, if not segregated in reserves, must also be included in all sanitary reforms.

Preventive medicine has a great future in East Africa, and, if Public Health work is carried out on proper lines, the country can be rendered quite suitable for European colonisation.

